Exploring Teacher Talk During Mathematics Instruction in an Inclusion Classroom

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ABSTRACT. The authors examined aspects of teacher talk during mathematics lessons in a 1st-grade inclusion classroom. Using content analytical coding methods, they analyzed 4 lessons—each taught by a different teacher in the classroom. Results showed that the patterns of teacher talk across all 4 teachers were chiefly recitational and lacking characteristics of talk consistent with the National Council of Teachers of Mathematics (NCTM) Communication Standard (2000b). Implications include that students with disabilities may benefit from instructional strategies that develop thinking and communication skills and that researchers and educators should identify and remove barriers to the provision of instruction congruent with the NCTM Standards for students with disabilities.

Keywords: inclusion, mathematics instruction, NCTM Standards, special education, teacher talk

Students with mathematics disabilities must receive effective and appropriate mathematics instruction in the placements to which they are assigned. This means providing them with instruction that addresses individual weaknesses and aims to accelerate their mathematics learning to raise individual mathematics achievement to grade level. In accordance with this aim, the National Council of Teachers of Mathematics (NCTM) has recently formulated and set the Principles and Standards for School Mathematics (2000a). The Standards conceive mathematics as a principled discipline that is based on the conceptual understanding of key ideas. This conceptual understanding is best developed when instructional processes require students to "take an active role in offering conjectures, responding to one another's ideas (and the teacher's), and defending and justifying their ideas and opinions" (Spillane & Zeuli, 1999, p. 5). Problem solving and collaborative work are emphasized, and students are encouraged to defend answers, explain approaches, and propose alternative solutions.

The present study focused on instructional strategies that support the Communication Standard (NCTM, 2000b), which calls for students to use communication skills for organizing mathematical thinking, sharing ideas coherently and clearly with others, analyzing and evaluating the mathematical thinking of others, and expressing mathematical ideas precisely. Instruction promoting these and other process goals included in the NCTM Principles and Standards (2000c) has not generally been used when instructing students with disabilities (Cawley, 2002). Nevertheless, advantages of using standards-based mathematics instruction for these students include using new approaches that may benefit students who have not done well with traditional or calculation-centered approaches (Giordano, 1993) and that may prepare them for the necessity of passing standardized state mathematics tests (Cawley, Parmar, Foley, Salmon, & Roy, 2001).

Sociocultural theories of learning view social interaction as constitutive for learning. In this view, learning is thought to be both individual and social, so that participation in social exchanges is necessary to the internalization of learning and knowledge (Rogoff, 1995; Wells, 2000). It then follows that social discourse functions as a tool for teachers to use in constructing effective teaching strategies and developing active learning roles (Palincsar, 1998). In this observational study, our primary purpose was to explore the nature of classroom verbal interaction and the congruence of instructional approaches with standards-based mathematics pedagogy in a first-grade inclusion classroom. The exploration was motivated by our belief that students with disabilities would benefit from mathematics instruction that encourages knowing as well as doing (Cawley, 2002) and that interactive dialogue is crucial for the development of knowing.

A secondary purpose of the study was to explore the congruence of mathematics instruction discourse among multiple teachers. Students with disabilities who are placed in general education classrooms are often involved in instructional arrangements that may include general education teachers, special education teachers, teacher aides, and

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perhaps even parent or community volunteers. Although researchers and educators have shown a great deal of interest in collaborative teaching arrangements in general education, very few researchers have investigated collaborations between general and special education teachers (Duke, 2004), addressed the use of mathematics co-teaching arrangements with young children with disabilities, or examined coherence of instructional approaches across teachers.

We identified six categories of teacher utterances: (a) question/elicit, (b) respond to students' contributions, (c) organize/give instructions, (d) present/explain, (e) evaluate, and (f) sociate. We developed individual teacher profiles to illustrate instructional approaches used by particular teachers. Nevertheless, teacher discourse was relatively similar across all teachers, who generally maintained tight control of the lesson by using recitation-like discourse patterns and providing few opportunities for student initiative and discussion. In this study, we discuss implications that include (a) the need to develop instructional strategies that are both congruent with the NCTM Communication Standard and effective for developing thinking and communication skills in students with disabilities and (b) the need to identify (and remove) barriers to providing such instruction.

To date, few researchers have investigated teacher discourse during mathematics instruction involving young children with disabilities in inclusion classrooms. The present study was intended to fill that gap. It also was intended to respond to the stated need for more investigation of "educator-related factors such as knowledge of mathematical thinking and pedagogical skills" (Aunio, Hautamäki, & Van Luit, 2005, p. 143) by focusing on communication strategies used by multiple teachers during mathematics instruction.

Teaching the NCTM Standards and Mathematics Discourse

Teaching the NCTM Standards. Although the Process Standards enumerated in the NCTM Principles and Standards (2000c) advance a view of mathematics as problem solving, communication, and reasoning, it is likely that many teachers are more accustomed to defining mathematics by its content. For example, mathematics can be defined as number sense and numeration, whole number computation, fractions and decimals, and so forth. This is where difficulties arise; understanding mathematics as principled knowledge requires a different style of teaching than teaching primarily for memorization and computation.

Teaching mathematics with the assumption that mathematics is as much conceptual as procedural is a complex and high-skill activity requiring teachers to not only master procedures and algorithms but also judge quality of thinking, explanation, argument, and evidence-based decisions (Lappan, 1997). These expectations contrast with a traditional teaching-as-telling pedagogy characterized as "dualistic in the sense of having a right/wrong orientation with mostly single procedures to arrive at the correct answer" (Cooney, 1999, p. 167). Changing practice is difficult for teachers who not only have long-held conceptions of mathematics as primarily procedural but also may doubt their own ability to be effective mathematics teachers (Bursal & Paznokas, 2006).

Discourse during mathematics lessons. Unfortunately, teachers often ignore the interactional routines that shape academic tasks, using only instructional strategies that center on mathematical artifacts and products and that require students merely to "compute simple answers, recall information, or describe procedures previously learned" (Blanton, Berenson, & Norwood, 2001, p. 233; Draper & Siebert, 2004). For example, Hamm and Perry (2002) found that questions asked during mathematics lessons by 6 first-grade teachers were overwhelmingly questions with known answers (91.5%). This suggests a tendency to emphasize teaching-as-telling approaches that position students as passive recipients of instruction and teachers as authoritarian arbiters of what counts as knowledge, the default approach for many teachers (Smith, 1996). Further, Hamm and Perry found that almost all student responses (96.5%) were simply verified by the teacher (e.g., "Very good") and not followed with invitations to share explanations and ideas. Even when the teachers made statements such as, "Let's do it together," the subsequent activity and discourse tended to be teacher driven.

Similarly, special education teachers tend to provide more directive (i.e., command, suggest, question) than responsive (i.e., elaborate, repeat, acknowledge) verbalizations (Kim & Hupp, 2005) and to use low-level and known-answer questions (Hamm & Perry, 2002; Hestenes, Cassidy, & Niemeyer, 2004). Discussions involving problem solving and reasoning activities may represent a problematic participation structure for students with disabilities, who often have difficulties with discriminating key information in mathematics tasks and with using metacognitive strategies (Maccini & Gagnon, 2002). Nevertheless, although young students may lack proficiency in maintaining a dialogue, they can learn thinking behaviors such as explaining, disagreeing, demonstrating, asking questions, and making suggestions for solving a problem (Berry & Englert, 2005; Venville, Adey, Larkin, & Robertson, 2003). To engage in these behaviors, students need teachers who provide opportunities for discussing, explaining, and reasoning.

Using NCTM-congruent instruction to teach mathematics to students with disabilities. The call to provide students with increased opportunities for problem solving and reasoning extends to teachers of students with disabilities (Giordano, 1993; Miller & Mercer, 1997; Parmar & Cawley, 1997; Thornton, Langrall, & Jones, 1997; Woodward & Baxter, 1997), and many effective, NCTM-congruent practices for teaching mathematics to these students have been developed. These include (a) focused and quickly paced lessons with multiple opportunities to respond; (b) opportunities to increase problem-solving skills; (c) modeling, or talking aloud while demonstrating a new concept; and (d) questioning students during guided practice to

check understanding (Paulsen, 2005). Yet, although students with disabilities have increasingly received academic instruction in general education classrooms (McLeskey, Henry, & Axelrod, 1999), few researchers have investigated mathematics instruction in those contexts, and even fewer have focused on teacher discourse.

One study that did so provided a close look at teacher and student discourse during mathematics instruction in a fourth-grade inclusion classroom (Baxter, Woodward, Voorhies, & Wong, 2002). In the Baxter et al. study, an experienced teacher who had been involved for several years in research efforts to include students with disabilities in mathematics instruction instituted once-weekly performance assessment lessons. Over time, the teacher's discourse changed from mostly managing behavior and lesson flow to prompting mathematical reflections. Results for students with disabilities included increased participation in small groups and increased reporting out activities. Although the results suggested that it is possible to implement effective interactive discourse practices, the mathematics lessons involved were weekly rather than daily and involved only one teacher.

A secondary purpose of the present study was to explore the congruence of mathematics instruction discourse among multiple teachers. Instructional coherence was first raised as an issue with regard to remedial reading instruction. Johnston, Allington, and Afflerbach (1985) found that incongruent reading instruction for students with disabilities (a) resulted in confusion about the goals of instruction and problem-solving strategies to be learned and (b) hindered students' learning. Reasons for incongruity were thought to include lack of communication among teachers and incompatible instructional ideologies (e.g., decoding vs. meaning approaches to reading). More recently, Pugach and Wesson (1995) described a mathematics classroom where all students were required to work with three teachers who had different approaches to mathematics. At worst, students were confused. At best, they dealt with the situation as best they could, often devising their own "idiosyncratic criteria for selecting from among the competing explanations" (Pugach & Wesson, p. 291). More work needs to be done to address situations such as these.

One of the few studies that focused on the roles of general and special education teachers in inclusive settings found that, in general, the teachers used "multiple approaches to teaching content matter" and that when there were problems, they "continued to problem solve until they found solutions to the needs of their students that were satisfactory to all concerned" (Laframboise, Epanchin, Colucci, & Hocutt, 2004, p. 38). However, results were not analyzed by content area, so no conclusions could be drawn with regard to instructional roles or coherence in subjects about which there might have been disagreement regarding approach (e.g., in reading, phonics vs. whole language; in mathematics, traditional vs. standards based). Rather, the researchers focused their attention chiefly on organizational and structural issues, similar to most such studies (cf. Bray, 2005).

In the present study, we investigated teacher discourse during daily mathematics lessons led by multiple teachers in an inclusion classroom. We were guided by these questions: What were the characteristics of teacher talk during mathematics lessons with students with disabilities? What was the extent of congruence of the discourse both with the NCTM Communication Standard and among the teachers?

Method

According to Lerman (2001) and other theorists, classroom discourse, among its many uses and functions, provides (a) information about articulated or unarticulated teacher expectations for student participation and learning and (b) evidence regarding pedagogical preferences and practices (Artzt & Armour-Thomas, 1999). Consequently, for this study, we selected the examination of *discourse*, defined broadly as teacher talk that may or may not support student learning (Burbules, 1993; Cazden, 1988), as the most useful approach for investigating teacher expectations and communication norms for mathematics lessons in an inclusion classroom where 4 adults—2 credentialed teachers, 1 prospective teacher, and 1 paraprofessional—shared teaching responsibilities. We selected for examination as a topic a money unit with challenging problem-solving potential for students and also a challenge for teachers as they struggled to plan and deliver effective instruction.

Participants and Setting

We drew the present data from a year-long exploratory study involving mathematics instruction and activities in a first-grade inclusion classroom, with the goal of learning about effective mathematics instruction for young students with disabilities who are included in general education contexts.

Participants. Participants were 4 adult female teachers (all assigned pseudonyms): Ms. White, the general education teacher for this first-grade classroom; Ms. Taylor, a special education inclusion teacher; Ms. Young, a student teacher; and Ms. Green, a paraprofessional (see Table 1). Despite varying qualifications, the adults are collectively referred to in this article as *teachers*. The teacher participants in the study constitute a purposive sample.

Setting. The classroom was in a large, urban school district. During the study year, the school served 400 students in prekindergarten through Grade 2 and employed 32 teachers. Of the students in the school, 58% received free or reduced-price lunches. Of all students, 64% were African American, 32% were European American, 3% were Hispanic, and 1% self-identified as *other*. No students were English-language learners. Of the 21 students in this first-grade classroom, 10 were girls. Of the 21 first graders, 13 were African American and 8 were European American. Two thirds of the students in the class were eligible for the

TABLE 1. Teacher Characteristics

Name	Ethnicity	Education/teaching credentials	Years of teaching experience
Ms. Taylor	European American	Master's degree in learning behavior disorders, dual certification (general and special education)	21 years in elementary and middle school as special education resource room and inclusion teacher
Ms. White	European American	Master's degree in elementary education	31 years in general education, Grades 1–6
Ms. Young	European American	Fourth year of baccalaureate elementary education degree program, planning to attend graduate school the following year	No paid teaching experience
Ms. Green	African American	Noneducation associate's degree	10 years in private day care, 2 years substitute teaching in public schools

free or reduced-price lunch program. Of the students, 5 received special education services. Of the 5, 2 qualified for nonacademic (e.g., speech, physical therapy) services only.

At the time of the study, the credentialed teachers, Ms. White and Ms. Taylor, were in their 3rd year of coteaching. The five students identified for special education services received almost all of their academic instruction (except reading instruction) in the inclusion classroom. All students received their primary mathematics instruction there; the low mathematics achievers met in the hallway before and after whole-class lessons to receive preteaching, extra assistance, and remediation.

This study is consistent with a definition of *inclusion* as a service rather than a location. Therefore, whether instruction was delivered inside the four walls of the classroom or out in the hallway, the classroom is considered an inclusion context. That is, mathematics instruction was planned and delivered by both general and special education teachers, and all students were taught according to the same curriculum.

The money unit. We observed and videotaped mathematics lessons during a 2-week money unit. The teachers used the district-selected mathematics program. Compared with other mathematics programs, they preferred this program's more sequential structure, longer time spent on each topic before moving to a new topic, and more teaching resources (e.g., games, literature) to address diverse needs. Ms. White and Ms. Taylor jointly planned weekly mathematics lessons. On the basis of these plans, Ms. Taylor, the special education teacher, planned preteaching and remedial activities for the identified students to support the mathematics instruction that they received in the inclusion classroom alongside their general education peers.

Daily mathematics instruction was typically structured to include a 20-min whole-class lesson, preceding ability-based small group activities, with one group consisting of the five students receiving special education services. With 4 teachers assigned to the classroom, up to four small groups could be supervised by an adult. Everyone worked on the same worksheets during small-group time, with modified expectations. Higher achieving students often received less supervision and were able, within the allotted lesson time, to complete an enrichment activity in addition to the planned worksheets. The special education students usually completed only portions of the worksheets.

General goals for mathematics instruction, according to interviews with the credentialed teachers, included meeting "at least 75% of the [district] curriculum goals at about a 75–80% level" and completing the state curriculum. The teachers' academic goals for the students with disabilities included "learning the value of the coins [pennies, nickels, and dimes] and just some simple counting." Social goals for the students included having "other kids respect [the students with disabilities], treat them as part of the group, and be willing to work with them in a small group or when we do peer activities."

Data Coding and Analysis

Investigator activities included videotaping lessons, conducting teacher interviews, and making field notes. We took a nonparticipant observer role in the classroom.

Primary data. Primary data included four videotaped mathematics lessons. We videotaped an entire unit on money, capturing (a) as many of the whole-class lessons as possible and (b) small pull-out groups that met in the hallway or occasionally in the resource room. The corpus of videotapes included 37 whole- or small-group lessons or portions of lessons taped over 2 weeks for a total of 8 hr of videotaped data. Because teachers' discourse and interactions with students with disabilities and low mathematics achievers were the focus of this investigation, a stratified

sample of four lessons, one for each teacher, was randomly selected for analysis. By chance, the lessons selected to represent Ms. Green's and Ms. Young's instruction occurred early in the unit, and those selected for Ms. White and Ms. Taylor occurred near the conclusion of the money unit.

The lessons led by Ms. Taylor, Ms. Green, and Ms. Young featured small-group participation structures. Ms. Green and Ms. Young held their lessons in the hallway just outside the classroom door, as is typical in many schools, whereas Ms. Taylor often took the group to her resource room, a comfortable space close by. Ms. White, the general education teacher, led the whole-class lessons.

In addition to the videotapes, transcripts of four interviews with Ms. White and Ms. Taylor and our field notes contributed to the interpretation of the data.

Coding procedures. In preparation for coding and analysis, we made transcripts of the selected lessons and segmented them into interchanges. An *interchange*, as a component of teacher talk or discourse, is defined as "an instance of verbal interaction between teacher and student that may include one or more comments" (Roskos, Boehlen, & Walker, 2000, p. 236). In this study, each interchange contained one teacher turn and its subsequent student response. These are examples of interchanges (a single slash [/] indicates a 1-s pause):

Example 1. Ms. Green: So, you need 10 cents. You need 5 plus //
Pat: Nickel.
Example 2. Ms. Taylor: Very good. Okay. Now, let's count it again, and then we will trace. Let's count first, pointing /
Students: 10, 20, 30, 40, 41, 42.

To isolate and typify the discursive strategies used by each of the teachers, we selected a content analytical approach to coding the transcripts. Coding followed a procedure recommended for examining videotaped data (Erickson, 2006). First, discourse functions of interest were identified and a "start list" (Miles & Huberman, 1994, p. 58) for coding was constructed. This initial list of codes was based on previous work (Berry, 2006) with additional codes derived from studies of mathematics discourse to create a coding scheme sensitive to teacher talk focusing specifically on mathematics problem solving and various teacher moves such as giving feedback, probing students' reasoning, providing evaluations, and prompting recall (Blanton et al., 2001; Hamm & Perry, 2002; Meyer & Turner, 2002).

Second, we coded the four transcripts, and all instances of each discourse move were identified. Two doctoral students, who were experienced with this type of coding, coded the transcripts. Prior to coding, we conducted a training session to familiarize the coders with this data set and list of codes. Each interchange was coded with none, all, or any combination of the a priori codes. For example, the interchange, "A penny. How much is a penny?" was coded as both simple repetition ("a penny") and extended questioning ("How much is a penny?"). Although causing category frequencies to sum larger than teacher totals, this type of multiple coding, according to Roskos et al. (2000), resists an inclination to oversimplify a complex and nuanced phenomenon. The coders added additional codes as needed for an eventual total of 47 codes. When new codes were added, transcripts already coded were reviewed in light of the new codes and recoded, if necessary. Both coders coded all four transcripts, "check-coding" (Miles & Huberman, 1994, p. 64) as they proceeded. In this way, all discrepancies were eventually resolved, for total interrater agreement.

Third, we entered frequencies of occurrence into a unit by variable matrix using SPSS database software. Similar codes were consolidated until a group of six main categories of teacher talk seemed the best fit for the data. To consolidate codes, we created dummy variables in SPSS. In this process, interchanges coded in more than one of the subcategories being consolidated were counted only once for the new code.

Fourth, we identified examples of what "instances look like in actual performance" (Erickson, 2006, p. 186) and provide them in the text that follows.

Data analysis. We undertook two analyses to (a) characterize teacher talk across all 4 teachers and (b) develop individual teacher profiles. To this end, descriptive statistics were computed, and 2×2 contingency table analyses with Pearson chi-square tests were conducted to test the relation between teacher and category of utterance (see Table 2). We identified significant relations at $p < .05$.

Results

We identified six categories of teacher utterances: (a) questioning/eliciting, (b) responding to students' contributions, (c) organizing/giving instructions, (d) presenting/explaining, (e) evaluating, and (f) sociating. We discuss them in order of overall frequency (see Table 2).

Questioning/eliciting. Two questioning patterns, eliciting and incremental questioning, showed that, in these lessons, teachers relied on questioning techniques to elicit and manage student involvement. The eliciting techniques used almost exclusively were questions directed to the group in general (e.g., "Who can tell me . . .") or to specific individuals (e.g., "Tell me what that coin is, Tina"). *Incremental questioning,* which Blanton et al. (2001) defined as "a series of simple, closed, leading questions that funneled students toward a final answer" (p. 232), characterized Ms. Taylor's talk in particular (see description of Ms. Taylor's profile in the Discussion).

Questions accounted for 45% of all teacher utterances. The experienced teachers, Ms. Taylor and Ms. White, demonstrated statistically significantly higher use of questioning techniques than did the inexperienced teachers, with Ms. Taylor using more incremental questioning (35%) and Ms. White using more eliciting (36%).

Responding to students' contributions. The utterances of responding to students' contributions provided responses, other than evaluating (see following text), to students'

TABLE 2. Comparison of Teachers on Types of Teacher Utterances

	Taylor		White		Young		Green		Total			
Category	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	χ^2	*p*
Eliciting/ questioning	66	54.1	41	56.9	37	36.6	45	35.7	189	44.9	15.48	.001
Responding	58	47.5	29	40.3	39	38.6	34	27.0	160	38.0	11.38	.01
Organizing	39	32.0	25	34.7	38	37.6	52	41.3	154	36.6	2.47	.48
Presenting/ explaining	41	33.6	20	27.8	38	37.6	29	23.0	128	30.4	6.56	.09
Evaluating	20	16.4	2	2.8	7	6.9	11	8.7	40	9.5	11.39	.01
Sociating	2	1.6	0	—	0	—	3	2.4	5	1.2	3.82	.282
Total	122	100.0	72	100.0	101	100.0	126	100.0	421	100.0	—	—

Note. $N = 421$, $df = 3$.

contributions and composed 38% of all teacher utterances. Utterance types included acknowledgement or repetition (e.g., "Yes, two dimes"); *elaborated feedback*, defined as adding something to the acknowledgement of a correct response (e.g., "Twenty-five. Twenty plus five more is twenty-five"); inviting evidence or an explanation (e.g., "Show me"); providing the correct answer (e.g., "Come on; this is a dime"); and working with incorrect or incomplete responses (see description of Ms. Green's profile in the Discussion). Of these five response types, acknowledgement was by far the most frequently used across all teachers. The frequency with which Ms. Taylor used responding utterances (48%) was statistically significantly higher than that of Ms. Green (27%).

Organizing/giving instructions. This category included starting the lesson (e.g., "Today we're going to . . ."), directing its procedural aspects (e.g., "We're going to go to the next row"), directing students' attention (e.g., "Look at this chart"), and regulating students' behavior during the lesson (e.g., "We need to listen"), accounting for 37% of all interchanges.

Presenting/explaining. Interchanges that dealt with lesson content (i.e., recalling, explaining, and repeating information or procedures) were coded in this category. This included stating basic information (e.g., "The dime is 10 cents"), explaining or recalling procedures (e.g., "When we get to our pennies, we're going to count by one"), and directing students to repeat a process (e.g., "Let's count the dimes again"). This category composed 31% of all interchanges.

Evaluating. Evaluating was narrowly interpreted to include only overtly evaluative remarks (i.e., praise or its opposite), such as "very good." Evaluations were either positive or negative and could be simple (e.g., "Very good"; "No") or extended (e.g., "Very nice. I see nice counting"; "No, we're counting by fives"). Although used relatively infrequently at 10% of all teacher utterances, its use varied statistically significantly by teacher, with the credentialed teachers representing the high and the low.

Sociating. We identified a group of utterances as *sociating* strategies (Cullen, 1998), or strategies designed to draw students into the lesson dialogue as well as to manage and maintain the social relations of the lesson. These included holding the floor for reluctant or unheard speakers (e.g., "Patrick is talking. We're supposed to listen"), assigning credit for ideas (e.g., "Tina told me we had four dimes"), and encouraging students to share their knowledge (e.g., "Listen to what Patrick is going to tell you"). This category was distinguished by the absence of interchanges that could be coded. Of the 421 interchanges coded for all 4 teachers, less than 2% of teacher talk fell into this group. Only Ms. Green and Ms. Taylor provided any interchanges that coded as sociating talk.

Summary

We did not find differences among the teachers regarding frequency of use for three categories of utterances: organizing, presenting/explaining, and sociating. We found statistically significant differences in frequency of use for three categories: eliciting/questioning, responding, and evaluating. However, no explanatory patterns of teacher use were evident. Overall, mathematics lessons were chiefly recitational. Content-related teacher talk comprised elicitations of recall-based responses, preceding acknowledgement of those responses. This pattern was similar across the 4 teachers. They rarely asked students to provide explanations, share ideas, or assist peers.

Discussion

Teacher Talk and Instructional Strategies: Individual Teacher Profiles

Overall, Ms. Taylor's (special education) instructional discourse made frequent use of incremental questioning and acknowledging and evaluating student responses. Ms.

White's (general education) discourse was characterized by her use of eliciting utterances and lack of evaluating comments. Ms. Young's discourse was distinguished by her low use of incremental questioning. Ms. Green's discourse was notable for her use of sociating utterances and her infrequent use of acknowledgement and eliciting.

Ms. Taylor and Ms. Young: Recitations. All three of the small group lessons analyzed for this study required students to complete a worksheet from the basal curriculum materials. Ms. Taylor's and Ms. Young's lessons involved counting and totaling the coin values of groups of coins. The instructional styles of both teachers were similar, and we discuss them together.

Both used a recitation pattern. They tended to package knowledge into small, incremental units bookended by general and direct call and—more typical in Ms. Taylor's style—acknowledgement. The following excerpt from Ms. Taylor's transcript illustrates this pattern (in all of the following excerpts, *T* represents the teacher, and *Ss* represents the students):

T: Cindy, how much are those nickels worth?
Cindy: Five cents.
T: Five cents. Very good. How many pennies are there in [item] number two, Laura?
Laura: . . . Four.
T: Four pennies. Okay. . . . And now when I count the nickels, what do I count by, Tina?
Tina: Umm, fives.
T: By fives.

In this excerpt, Ms. Taylor directly called on three students in turn. Each of the three interactions concluded when the teacher acknowledged the student's response by repeating it (e.g., "by fives"), repeating it with elaboration (e.g., "four pennies"), and occasionally adding an evaluative comment (e.g., "very good"). Each interaction involved a small, discrete unit of declarative knowledge: Nickels are worth five cents, there are four pennies in number two, and we count by fives when we add nickels.

The questioning style of the teachers and Ms. White (discussed in the following subsection) may be characterized as seeking to promote error-free responses. On the few occasions when students gave a wrong answer, Ms. Taylor typically did not characterize it as an error, as in the following two examples:

T: Count the dimes and then stop.
Ss: [counting] 10, 20, 30, 40.
T: Oh, I heard Patrick really followed those directions. He counted the dimes and then he stopped.

Ms. Taylor commended Patrick for following directions (not all students had participated in the choral response), implying that the other students had not (i.e., no error acknowledged). Another technique was to repeat the question with or without extra prompts until the correct answer was supplied:

T: How many dimes, Patrick?
Pat: A 10.
T: How many dimes, Patrick?
Pat: 10 cents.
T: How many dimes do you see on your paper?
Pat: Three.
T: Three; very good.

Ms. Young also often used the repeated question technique. Students generally interpreted repeated questions to indicate that their initial answers were incorrect. This was demonstrated during Ms. Young's lesson as follows:

T: How much is a nickel worth?
Tina: Five cents.
T: A nickel? How much is a nickel worth?
Pat: Five cents.
Tina: That's what *I* said.

Whether (a) Ms. Young intended to disrupt students' expectations by repeating a question that had already been answered correctly or (b) a miscommunication occurred, Tina's second response can be taken to mean, "My answer was correct, but you treated it as if it was wrong; now I am vindicated." One characteristic of the typical recitation pattern is that it provides reliable markers of progress. If the teacher asks a new question, the answer must have been correct, and the lesson proceeds.

Ms. Young most likely emulated instructional techniques used by the experienced teachers. She also used a great deal of choral response, which can mask individual lack of understanding. Focusing attention on the group rather than individual students is typical of new teachers (Athanases & Achinstein, 2003; Kagan, 1992; Wideen, Mayer-Smith, & Moon, 1998). In most instances when an individual student gave an incorrect response, Ms. Young either repeated the question or called on another student. Instances of follow up with the same student generally resulted from student inattention. Ms. Young's requests for an individual student to "look at your paper" or "show me" were a focusing technique, not a request for the student to explain something.

We found few of the interactional aims of the NCTM Communication Standard in Ms. Taylor's and Ms. Young's lessons. Their talk was characterized by elicitation of answers with little exploratory talk about the problem at hand. Presentations seemed to assume the immutability of mathematics knowledge, because they used only one approach: memorization. Memorization may be important as students learn names and values of various coins. However, when required to determine the total value of a group of coins (e.g., three nickels and four pennies), students were not encouraged to work this out on their own or to identify divergent solutions. Instead, both teachers broke the task into discrete parts: "How many nickels? . . . How much are nickels worth? . . . How many pennies? . . . When I count nickels, what do I count by? . . . Count the

nickels and then stop. . . . Now we will count this. . . . What is it called? . . . What is a penny worth?" Because the lesson seemed to be focused on completing the worksheet, it appeared that covering the material might have trumped teaching for understanding as a lesson goal.

Ms. White: Whole-group lesson leader. Ms. White's instructional strategies were intended to manage whole-class lessons, which have a participant structure different from that which the other 3 teachers used. Nevertheless, her instructional discourse was similar to that of Ms. Taylor and Ms. Young, thus failing to alter the recitational nature of mathematics instruction in this classroom. There were minor differences when compared with the discourse of Ms. Taylor and Ms. Young: Ms. White made more use of eliciting strategies (probably due to the whole-group lesson format) and used evaluation much less frequently. She tended to omit the evaluation and feedback step of the initiation-response-evaluation/feedback (Mehan, 1979) recitation format. The following transcript excerpt illustrates Ms. White's patterns of eliciting input and proceeding to the next question after receipt of the preferred response:

T: What are we starting with, everybody?
Ss: 25 cents.
T: Jim, you roll [the die] this time. . . . This time we got //
Ss: Five.
T: What coin is worth five, Tina?
Tina: A nickel.
T: So, how many did we say we're going to do, Laura?

This excerpt represents interchanges preparatory to the main lesson task, which, in this example, involved counting a group of coins. Ms. White often included the students with disabilities and low mathematics achievers, such as Tina and Laura, in these preparatory interchanges. In this excerpt, Ms. White used general and direct call and small knowledge units but did not acknowledge or evaluate. Nevertheless, the recitational quality of the interactions is unmistakable. There were no requests to show evidence or explain thinking strategies or find alternate ways to determine the coin totals.

The performance of the main task was accomplished in chorus:

T: 25. Count.
Ss: 30, 35, 40, 45, 50.

Although choruses often mask individual incorrect responses, the group response itself can be prone to error. The task in this lesson involved counting on by ones, fives, or tens from twenty-five, which is difficult for first-grade students. Ms. White dealt with incorrect chorused responses by stating or restating the process (e.g., "These are nickels. We're counting by five"), preceding whole-group practice (e.g., counting by fives).

Although educators and students have often considered recitation as stultifying, the benefits of recitation conducted at a lively pace include maintaining students' attention and increasing student response opportunities (George, 1986). Still, teachers must seek a balance between "evaluative" and "discoursive" follow-up (Cullen, 2002, p. 122). According to Cullen, *evaluative responses* repeat, praise, check understanding, and prompt (for preferred response), whereas *discoursive responses* reformulate and elaborate. Excessive evaluation tends to preclude exchanges focused on exploration and problem solving, whereas excessive discoursive responses may deny students the opportunity to notice and repair their errors. "Responsive" teacher talk (Cullen, p. 125) characterizes a pattern of talk that encompasses both evaluative and discoursive qualities in which the teacher listens carefully and responds appropriately, either in the moment by building on students' responses or in general by anticipating potential difficulties and structuring the lesson so as to handle them. Teachers who are fully responsive balance evaluation and discussion for the enhancement of students' learning.

Although the discourse of all four teachers was largely congruent with recitation structures, Ms. Green's discourse (which we discuss in the following subsection) had a more interactional character.

Ms. Green: Glimmers of interactivity. Ms. Green's verbal interactions with the students seemed qualitatively different from those of the other teachers. The credentialed teachers, Ms. Taylor in particular, expressed concern that Ms. Green, the classroom aide, often prematurely abandoned attempts to elicit correct answers from students and provided them herself. We observed Ms. Green's doing so on at least one occasion. Nevertheless, the investigator wondered in her field notes, "Is Ms. Green's talk perhaps more supportive or [does it] contain a higher degree of affect [than that of the credentialed teachers]? How much is 'too much' scaffolding, especially when learning new concepts?"

To interpret Ms. Green's instructional method, we examine more closely two categories: "provide the correct answer" and "work with incomplete or incorrect response." "Provide the correct answer" is self-explanatory. We used "work with incomplete or incorrect response" to identify interchanges when the teacher used the incomplete or incorrect response as a tool for further prompting or when the teacher restated the question in varying ways. Ms. Green was coded in "provide the correct answer" five times, followed by Ms. Young (twice), Ms. Taylor (once), and Ms. White (never). These data seem to support the allegation of answer telling. However, Ms. Green was coded in the "work with incomplete/incorrect response" subcategory nine times, followed by Ms. White (twice), Ms. Taylor (once), and Ms. Young (never). These incidences may seem few, but they may also indicate a pattern.

Of Ms. Green's nine instances of working with incorrect responses, she gave the correct answer only one time. In the other eight, she persisted until a student gave a correct response. The mean number of turns-to-correct-response was 10.3, with a range of 4–26. None of the other teachers spent as many turns in trying to elicit a correct response.

The following was a typical exchange in Ms. Green's group. In this example, Ms. Green continually restated the problem in different ways.

T: We need 13 cents. The dime is 10 cents. How many pennies do we need to make 13 cents?
Pat: Oh. 10 cents.
T: How many pennies?
Pat: 13 cents.
T: . . . We have the dime. How many pennies do you add to make 13?
Pat: One.
T: . . . How many pennies do we need to add to the dime?
Pat: Three.

In addition to restating the problem in different ways, Ms. Green at times used part of the incorrect response as a tool to prompt the correct response, a technique that—these transcripts indicated—the other teachers did not use in these lessons.

T: Look at number seven. . . . How many coins do we need to make three cents, Vivien?
Viv: This is a dime.
T: Do we need a dime? The dime is 10 cents. That's too much. We only need three cents.
Viv: So this one, this one, and this one.
T: So, how many do we need?
Viv: Three.
T: Three pennies.

Instead of saying, "No, not a dime," Ms. Green used information about dimes to provide a further prompt: "That's too much. We only need three cents."

A third technique used exclusively by Ms. Green involved a concept instruction strategy, divergent examples, illustrated in the following two excerpts:

T: We need 17 cents. . . . How many pennies do we need to add to the dime?
Pat: One.
T: If we only add one, it will only be 11 cents.
Pat: Seven.
T: Look at number six. We need 12 cents. . . . We have a dime. How many more pennies do we need to make 12 cents, Vivien?
Viv: One.
T: If it's one, it will only be 11 cents. We need 12 cents.
Ss: Two.

In each of the three examples just shown, Ms. Green seemed to have provided a useful prompt, because students provided the correct answer immediately.

In the following example, Ms. Green did not receive the response that she sought.

T: Okay. So five pennies will make one nickel. How many nickels do we need to make a dime? Patrick?
Pat: Um // 10 pennies // um 5 pennies.
T: No. How many of these to make this? [Points in succession to pictures of nickels and a dime.]
Pat: 10 cents.
T: We know it's ten cents, but how many of these to make 10 cents? How much is a nickel worth?
Pat: Five cents.
T: So you need 10 cents. You need 5 plus //
Pat: Nickel.
T: Plus?
Pat: 10.
T: No.

This was a more difficult problem than counting pennies. It could be argued that Ms. Green's failure in this example was a failure of problem-solving technique or inadequate language to express mathematics concepts, not a tendency to prematurely provide answers without engaging the students in problem solving, as Ms. White and Ms. Taylor had feared.

With regard to sociating talk, Ms. Green's discourse contained more instances than that of the other teachers. Although Ms. Green's three instances of the use of sociating talk are hardly sufficient for building a defensible case, she was the only 1 of the 4 teachers to hold the conversational floor for a student (e.g., "Patrick is talking. We're supposed to listen") or to position students as knowledge sources (e.g., "Listen to what Patrick is going to tell you"; "Tell her what you have just told me"). Information bearing is typically a role that teachers reserve for themselves (Buzzelli & Johnston, 2001). Ms. Green was the only 1 of the 4 teachers to share this role with the students.

In relation to the other teachers, Ms. Green's greater use of strategies to work with incomplete or incorrect responses and encourage students to share knowledge may mark her talk as more aligned with the NCTM (2000b) Communication Standard than that of the other teachers. Her tenacity in eliciting correct responses from students and use of sociating talk may indicate a tendency to encourage interactions around the lesson tasks, rather than to perform recitations. It should also be mentioned that individual characteristics might have been a factor: Ms. Green and four of the five target students were African American.

In summary, Ms. Green's instructional approach may have derived from a dearth of instructional tools for helping students to problem solve. Although her approach contained more sociating talk and dealt more fully with incomplete responses than did the approaches of the other teachers, it nevertheless was mostly recitational. She may have been responding to the same time constraints felt by Ms. Taylor and Ms. White, who objected to what they perceived as pressure from the district to cover material at a pace too rapid for mastery. During the lesson in which the investigator observed Ms. Green telling answers, Ms. Green told the children several times, "We have to do another game." She was working from a task list created by the experienced teachers. It may be that while Ms. Taylor thought that Ms.

Green either did not understand or ignored her instruction to "show the children how to trade coins," Ms. Green was trying to complete the task list.

Teacher talk and the NCTM Communication Standard. Three of Mercer, Jordan, and Miller's (1999) six steps for planning mathematics lessons may be useful for identifying NCTM-congruent lessons. Those include (a) describe or model the skill or strategy, (b) scaffold interactive discourse, and (c) provide feedback. In the present study, the step of describing and modeling was accomplished when teachers built on previous modeling by enlisting students in performing the procedure together with the teacher (e.g., "Let's count. Ready? 10 . . . everybody? . . . 10, 20," and "Look at my paper. . . . When I point, you count").

Scaffolding techniques may be used to support interactive discourse. All of the teachers prompted declarative knowledge (e.g., "How much is a nickel worth?") and cued procedural knowledge (e.g., "We always start with the biggest coin," and "When we get to our pennies, we're going to count by one"). However, this is where characteristics of talk consistent with the NCTM Communication Standard (2000b)—such as students' volunteered responses, incorrect responses pursued as tools for further exploration of the problem, and probes of students' thinking processes—were generally absent. In addition, the overall discourse pattern for mathematics instruction did not vary across lessons or teachers: The direction of talk moved from teacher to student and back, rather than among students. Ms. Taylor and Ms. White were not unaware of the need to emphasize problem solving and probe students' reasoning. Ms. Taylor described how helping her own daughter with mathematics homework enabled Ms. Taylor to "see what route [mathematics] is changing to . . . . They have to do a lot more thinking. . . . Besides the kids doing the process, they have to give you a reason." We observed Ms. Taylor on occasion asking students why they gave the answers they did. None of those instances were in the lesson analyzed here.

Feedback can be effective for linking student effort and thinking processes with successful performance and construing errors as opportunities to learn. However, feedback was generally unelaborated (e.g., "very good") and instructional techniques generally avoided the recognition of errors.

In summary, the teachers used several instructional strategies considered effective for students with disabilities. However, for whatever reasons, we found few indicators of the NCTM Communication Standard (2000b), such as asking students to explain or seek alternative solutions, in these lessons. Mathematics instruction in this classroom was characterized by answer telling rather than problem solving.

Reasons for the Teachers' Instructional Approaches

Artzt and Armour-Thomas (1999) found several patterns of belief and practice among high school mathematics teachers, one of which may have explanatory use here. In their study, one group of teachers focused on content coverage and classroom management. Their instructional discourse was heavy with low-level questions, and students were not required to explain their thinking or interact with peers. These behaviors seem descriptive of the teachers in this study. Examination of the discourse of all 4 teachers revealed an instructional approach "driven by the belief that students learn best by receiving clear information transmitted by a knowledgeable teacher" (Artzt & Armor-Thomas, p. 227).

What may be reasons why the teachers engage in the types of discourse identified in this study? One motivation may have to do with time. At this point in the school year (May), they worried about being "behind. . . . Our goal is to get most of it finished before it's over" (teacher interview, 2007). During the debriefing session at the end of the unit, we asked Ms. Taylor and Ms. White about teaching problem-solving skills. They responded, "We're supposed to be doing problem solving all the time." The difficulty, in their perspective, was that "it takes us so long to do anything." By this time, Ms. Taylor and Ms. White were frustrated and disappointed with the results of the money unit: "The biggest problem is we're trying to rush it. . . . We're burned out. They are burned out." In their view, the time factor made compliance with district curriculum guides difficult (Brown & Hirst, 2007). The low academic level of their students required them to expend valuable instructional time on basic skills and review, severely limiting time that could be spent on problem solving. It is possible that they had decided that a recitational format was an appropriate vehicle for meeting the deadlines and goals.

Another factor influencing teacher–student interactions may have been difficulties with processing often exhibited by students with learning disabilities. Although lesson pace is important in maintaining student attention (George, 1986), too rapid a pace may not allow students time to consider the problem at hand. Additionally, difficulties with group discussion may have stemmed from developmental factors. Most young children are developmentally unprepared to handle conversational skills such as topic sharing. Also, children from economically disadvantaged backgrounds may not have participated in conversations with their caregivers to the same extent as middle-class students, yielding a situation that may interfere with the development of conversational skills (Bloom, 1998).

A further explanation may be grounded in the teachers' view of the lesson content. Their specific goals for the students with disabilities for the money unit were to learn coin values and simple counting, what they considered to be the "core material" or the "basics." Researchers have shown that direct instruction is effective for learning basic mathematics facts (Kroesbergen & Van Luit, 2003). Perhaps these teachers considered coin values basic in this regard. They may have selected a recitational lesson type as appropriate for teaching the basics. However,

if the teachers had regarded counting amounts of coins as problem-solving skills, then they might have selected self-instruction approaches (Kroesbergen & Van Luit). *Self-instruction* involves providing students with prompts in the areas of problem definition, planning, self-evaluation, error correction, and such (Goldman, 1989) and has also been shown to be successful with students with disabilities (Kroesbergen & Van Luit).

Still another basis for the credentialed teachers' choice of instructional strategies, in addition to concerns about time constraints and appropriateness of basic skills instruction, may be in the "paradox of teaching" (Artzt & Armour-Thomas, 1999, p. 228; Crespo, 2002) that confronts teachers in any situation: the need to "maintain the 'tension' between simultaneously covering the content and attending to student understanding" (p. 228). At the end of the year, the teachers felt pressure to complete the curriculum. With regard to student understanding, they felt that much of the first-grade mathematics curriculum was "introductory" and were concerned about "exposure" (teacher interview, 2007) to many concepts that would be mastered in later grades. Perhaps they felt that providing exposure was their primary task, with student understanding a secondary outcome, although desirable and gratifying when it occurred. In this regard, they may have been caught between district intentions (i.e., exposure) and parent expectations (mastery), so that their own situation confirmed the paradox of teaching.

Implications and Conclusion

The exploratory nature of this study does not invite definitive conclusions. To make such, more information is necessary. Examination of teacher discourse in other mathematics units and in other subject areas across an entire school year would provide a more complete picture of these teachers' instructional behaviors. Also, examination of the discourse of additional credentialed teachers, student teachers, and paraprofessionals in a multiple case study would be useful in corroborating or refuting these results. Additionally, not all teachers and students were interviewed regarding mathematics instruction and learning during the money unit.

Categories of Teacher Mathematics Discourse

For this classroom, we could characterize teacher talk during mathematics instruction by six types of utterances. The most frequently used type involved questioning to elicit participation, check student understanding, and give speaking rights to a student. Questions are ubiquitous in teacher talk; what are revealing are the types of questions that teachers use. For example, questions can be used to maintain teacher control, support student autonomy (Meyer & Turner, 2002), or ensure student understanding (Paulsen, 2005). Unfortunately for mathematics problem solving, known-answer questions tend to dominate teacher talk (Hamm & Perry, 2002; Kim & Hupp, 2005), evoking the ubiquitous recitation format: initiation-response-evaluation/feedback (Cullen, 2002; Mehan, 1979). In this pattern, the roles of teacher and student are unequal. The teacher casts students in the role of learners, unknowing and unable to evaluate their own responses, whereas the teacher is the authority and arbiter of what counts as knowledge. Almost half of all teacher talk in these lessons was of this type and associated mostly with the experienced teachers. The ubiquity of this discourse pattern may indicate a lack of teacher talk aimed to extend and challenge students' thinking, goals advanced by the NCTM Communication Standard (2000b).

A second major function of the teacher talk in these lessons was to respond to contributions elicited by questioning students. The most used technique was simple acknowledgment of the student's effort, both to indicate that the teacher was paying attention to the dialogue and to call the attention of the other students to the contribution. Ms. Taylor made much use of this technique. Occasionally, she and the other teachers provided elaborated feedback to supply more information. Only Ms. Young, in a very few instances, invited students to present evidence or explanations of their thinking. As discussed previously, Ms. Green strove to lead students' thinking by using incorrect or incomplete responses as thinking tools.

Unsurprisingly, all 4 teachers engaged in verbal instruction-giving and organization. This is necessary for directing the procedural aspects of the lesson, directing students' attention, and managing classroom behavior. As a teacher names processes and techniques, tells next steps, and signals transitions, the lesson flow proceeds more smoothly.

Presenting and explaining entails recalling, explaining, or repeating lesson content. Although this category may be what teachers are typically thought to do—expound lesson content—it was fourth in frequency of use. This infrequency may be accounted for by the fact that the small-group sessions involved lessons that built on content previously either presented during whole-group lessons or practiced in small-group formats.

Evaluating is a category of response also typically associated with a recitation format. Ms. Taylor used evaluation as often as the other 3 teachers did together. This frequency may have been because of her skill in using the incremental questioning pattern to lead students step-by-step to the correct response, with frequent evaluation of student response. Ms. White's use of this move was least frequent of all teachers, probably because she omitted it to propel the lesson forward.

Sociating utterances, those utterances that may be most conducive to encouraging and sustaining sense-making and deep understanding as the NCTM Communication Standard (2000b) called for, were used by only 2 teachers and rarely even then. One type of sociating utterance involves *holding the floor*, that is, barring listeners from cutting off a

speaker until the speaker has concluded the verbalization. This serves to sustain the student's involvement in the dialogue, ensure sufficient time to talk, and allow a quiet voice to speak, all of which may be particularly crucial for students with receptive and expressive language difficulties. Another aspect of sociating is *assigning credit*, that is, the teacher's using a student's idea to advance the lesson and crediting the student with having the idea. In this way, students may come to understand that they are allowed, even expected, to develop their own thinking and reasoning skills. Sociating also may involve *encouragement*, that is, establishment of a nonthreatening atmosphere and acceptance of efforts that approximate the desired outcome, again promoting the idea that sense-making is as valuable as applying procedures.

Implications for Educators

Researchers may draw several implications from this study with regard to instructional strategies that support NCTM standards (2000a) and that are effective with students with disabilities.

Develop complementary instructional strategies. Teachers of students with disabilities need to have confident, knowledgeable, and masterful use of multiple approaches, whether traditional or problem centered. They must be able to skillfully combine the use of different approaches at the appropriate times. Currently, it seems that dissimilar approaches have been cast as opposing views, with the new (conceptual) approach seen as superior to the old (traditional) approach. Rather, these could be viewed as complementary, and a number of researchers who have summarized the outcomes of mathematics interventions for students with disabilities have recommended exactly this view (Fuchs & Fuchs, 2005; Kroesbergen, Van Luit, & Maas, 2004; Swanson, 1999). In this view, teachers are advised to use the most effective approach to achieve a specific objective. For example, they should use direct instruction to teach basic mathematics knowledge, such as mathematics facts; use self-instruction (i.e., verbal prompts to mediate cognitive and metacognitive operations) to teach processes (Kroesbergen et al., 2004); and use interactive instruction involving "discussion of strategies (i.e., general metacognitive and domain-specific heuristics), multiple solutions to problems, and a 'debriefing' component" (Woodward & Montague, 2002, p. 97) to teach problem solving.

Most teachers are proficient in the use of sequencing, practice-review, segmentation, directed questioning, and supplements (e.g., homework) to enhance student achievement but are less proficient in modeling, supporting social interaction, prompting, cueing, student reflection, peer collaboration, and so forth. To acknowledge the importance of the latter instructional strategies, teachers may need to alter their perspectives on teaching and learning from "teacher as authority and provider of knowledge to teacher as facilitator and co-investigator with students" (Clift & Brady, 2005, p. 319). In other words, addressing the process variables mentioned in the NCTM Standards (i.e., problem Process solving, reasoning and proof, communication, connections, representations; 2000c) may implicate teachers' conceptual change with respect to pedagogical orientation, an exceedingly difficult challenge (Berry, 2007).

Developing thinking and communication skills in students with disabilities. Instructional strategies that have been found to be effective with students with disabilities across academic areas include controlling task difficulty and instructing students in small groups (Vaughn, Gersten, & Chard, 2000). These were evident in the present study. Task difficulty was tightly controlled as teachers guided students through each task. As a result, students' responses were nearly error-free.

However, teachers of students with disabilities need to use additional strategies that initiate and support a deeper understanding of mathematics beyond facts, algorithms, and computation skills. For example, teachers can support students' verbal participation by using Ms. Green's strategies: holding the conversational floor for a reluctant or unheard student, positioning students as knowledge sources, and working with incomplete or incorrect responses. These strategies can be embedded in activities, such as having students make their own problems (Furner, Yahya, & Duffy, 2005) and asking students to demonstrate for each other their problem solution. For example, the study teachers, after working out several worksheet problems, might have asked students to (a) select a number of coins on their own and determine the value of the group, (b) select coins that would equal a value presented by the teacher, and (c) select coins that would make up the difference between values (e.g., given a nickel, find coins that that can be added to the nickel to make twelve cents). Many more such strategies could be generated.

Perhaps initial attempts to compel teachers to develop instructional strategies that are useful for promoting student communication could focus on learning new questioning patterns. Teachers are natural question askers; they could be directed to expand their repertoire by using questions such as "How do you know?"; "Is there another way?"; "Is there still another way?"; "What if we try . . . ?"; "What would happen if we . . . ?"; and "What is it that you did here?" (Mewborn & Huberty, 1999; Pape, Bell, & Yetkin, 2003). This results in different roles for teacher and students, who are positioned as "active participants with a share of the authority and accountability for contributing to their own and other students' understanding" (Greeno, 2006, p. 813). This shift in interaction pattern can profoundly shape students' learning and affect the depth of their understanding, for "students can learn to apply procedures and to explain meanings of concepts, but they learn differently if they participate by generating, questioning, and evaluating ideas than if they only hear teachers and read texts that do these things" (Greeno, p. 813). Allowing and encouraging students to reflect on and discuss their own thinking and reasoning and those of peers and teacher

are powerful practices toward developing new mathematical understandings (Fraivillig, Murphy, & Fuson, 1999; Knuth & Peressini, 2001).

Identify (and remove) barriers to providing instruction for students with disabilities. Although focusing on the impact of the NCTM Standards on special education teachers was not a goal of this exploration, it is nevertheless noteworthy that few researchers have addressed this area. The consensus among those that have seems to be that special education teachers have not fully aligned their mathematics instructional practices with the aims of the Standards. Reasons for this situation may include lack of awareness of the Standards (Giordano, 1993; Maccini & Gagnon, 2002), partly perhaps because of lack of mathematics requirements in some states for special education teachers (Graham & Fennell, 2001), problems with basal programs (Kameenui & Griffin, 1989; Parmar & Cawley, 1997), and adherence to traditional theories of knowledge and learning (e.g., behaviorist, mechanistic; Grobecker, 1999; Parmar & Cawley). In the present study, coverage of material seemed to be privileged over teaching for understanding, perhaps because of the teachers' unfamiliarity with NCTM goals, as evidenced in the absence of NCTM-congruent instruction or the demands of the basal program as represented by district directives.

In addition, difficulties may lie in the Standards (NCTM, 2000a) themselves. For example, Cawley et al. (2001) cited (a) ambiguity in the standards regarding how students with disabilities are to be taught mathematics and (b) the lack of exemplars of how real teachers have adapted their standards-based instruction to meet the needs of a wide diversity of students and learning problems (e.g., low reading ability).

Also, among teachers, a level of ambiguity remains regarding best practices for teaching mathematics to students with disabilities (Cawley et al., 2001; Kroesbergen et al., 2004), and preferred approaches can change as students move from one grade level to the next. For example, a difficulty that Jordan, Kaplan, and Hanich (2002) encountered in their attempt to use growth models to link mathematics achievement with specific instructional approaches (i.e., problem-centered vs. traditional) lay in the fact that the approach used by teachers varied among grade levels, making it impossible to suggest conclusions based on longitudinal data.

Effects of Multiple-Teacher Instruction

A question raised by the involvement of multiple adults in the delivery of mathematics instruction involves the effect of this situation on students. Students receiving special education services have long been required to navigate among multiple instructional contexts. Researchers could argue that the movement toward inclusion has not eliminated these navigational challenges but has focused them on one classroom, particularly when co-teaching is the instructional approach. It seems intuitive that having multiple adults available for instructional purposes would have educational benefits for students with disabilities. Empirical research has shown that collaborative teaching arrangements may be "moderately effective" in this regard (Murawski & Swanson, 2001, p. 264), particularly for students in Grades K–3 and high school. Benefits for students with disabilities include stability (more difficult to achieve when students regularly move among different classrooms), a wider range of potential friends and acquaintances, and an increased number of adult advocates (Laframboise et al., 2004; Pugach & Wesson, 1995).

However, incompatible teaching styles or approaches may cause difficulties and confusion for students. Future researchers should further examine how students with disabilities are affected by the need to adjust to varying expectations and instructional approaches of multiple adults in various teaching roles (e.g., credentialed teachers, prospective teachers, paraprofessionals). Nevertheless, students involved in the present study likely had little difficulty in adapting and actually were not required to adapt to varying expectations because of the significant overall instructional compatibility in this study (arguably for the wrong reasons). Still, researchers and educators might hope that, in mathematics inclusion classrooms with multiple adults in teaching roles, all would move toward teaching practices that value communication, problem solving, and reasoning.

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